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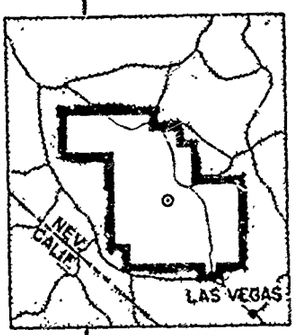

NEVADA TEST SITE
MAY-OCTOBER 1957

Project 36.1

FIELD RADIOLOGICAL DEFENSE
TECHNICAL OPERATIONS

Issuance Date: Sept. 9, 1959

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CIVIL EFFECTS TEST GROUP

Report to the Test Director

FIELD RADIOLOGICAL DEFENSE TECHNICAL OPERATIONS

By

B. C. Killian and A. H. Emmons

Approved by: H. D. IVEY
Director
Program 36

Approved by: R. L. CORSBIE
Director
Civil Effects Test Group

Federal Civil Defense Administration
March 1958

ABSTRACT

Project 36.1 was conducted to provide orientation, instruction, and practical training in radiological defense technical operations associated with a fallout radiation field. Techniques employed were foot surveys, vehicle surveys, and aerial surveys utilizing standard FCDA radiation detection instruments and other equipment. During field exercises data were collected for the evaluation of the several monitoring techniques on the beta-gamma ratio and in support of the technical projects of Program 35 conducting decontamination studies and aerial survey techniques.

The orientation program included briefings on the weapons testing program, scientific projects designed to improve the state of knowledge of the characteristics of fallout radiation, and the use of test results in radiological defense planning. Speakers representing the Test Manager, Test Director, Civil Effects Test Group Director, Military Effects Test Group Director, and the Camp Desert Rock Radiological Safety group furnished valuable assistance. Scientific personnel visiting the test site also helped.

A total of 56 persons designated by federal, state, and local organizations and having active roles in civil defense attended the two sessions of Project 36.1. Forty trainees participated in the first session, held June 17 to June 28, 1957, in conjunction with Project 36.2; the second session, Aug. 8 to Sept. 3, 1957, was attended by 16 trainees.

The objectives of the training projects were fulfilled. The response of participants was favorable; and participants recommended that the training projects be continued in future continental series.

ACKNOWLEDGMENTS

The authors wish to express appreciation and gratitude to the many individuals and organizations who gave their time so generously and without whose cooperation this project would not have been possible.

Colonel H. E. Parsons, Deputy Test Director; Camp Desert Rock Rad-Safe Unit; Program Directors from both Civil and Military Effects Test Groups; Edward R. Saunders, Chief, Federal Civil Defense Administration Operations; Dr. Gordon Dunning, Division of Biology and Medicine, Atomic Energy Commission; Dr. Stafford Warren, Dean of Medical School, University of California at Los Angeles; and Dr. Howard Andrews, Office of the Surgeon General, U. S. Public Health Service, contributed greatly to the success of the project.

Appreciation is also due Hugh D. Ivey, Director, Program 36, and Robert L. Corsbie, Director, Civil Effects Test Group, and his staff for their assistance and guidance in conducting the two sessions.

The Nevada Test Site Rad-Safe Organization extended the use of its facilities and personnel during both sessions, and this service deserves special commendation.

A list of the speakers from the various military and civilian projects is given in Appendix A. The authors are much indebted to these people, as well as to members of support organizations for their kind cooperation in helping to arrange the schedule and facilities and in contributing to the success of the project.

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CHAPTER 2 PROCEDURE

Chapter 1

INTRODUCTION

1.1 OBJECTIVES

Project 36.1 was conducted to give practical training and to provide field experience in radiological defense to federal, state, and local civil defense officials. Project activities included monitoring techniques for performing radiation surveys on foot, in vehicles, and in aerial flights. The participants assisted in evaluating standard Federal Civil Defense Administration (FCDA) instruments and in conducting beta-gamma absorption studies by using instrumentation designed for Project 35.4.

1.2 BACKGROUND

The first FCDA participation in nuclear test operations was in the fall of 1951; it was limited to a brief course in radiological monitoring for FCDA staff members. During the spring of 1952 the FCDA participated in Operation Tumbler-Snapper by conducting a study of radiological defense. The purpose was to familiarize FCDA personnel with radiological safety operations and problems of radiological contamination resulting from atomic detonations.

After these tests plans were made for a training program for state and local radiological defense personnel at the Nevada Test Site (NTS) during the 1953 series. The FCDA submitted a proposal for participation in a training project to the Atomic Energy Commission for these tests.

The first training project was conducted for three weeks during the 1953 series. Fourteen persons attended; each person was recruited by the FCDA from state and local civil defense organizations. The project was successful, and the FCDA decided to continue this type of field training in future test series.

During Operation Teapot (1955) at the NTS, the FCDA sponsored its second training project. The 24 participants were required to have radiological defense responsibilities and to have a background of knowledge and training in radiological health, safety, or defense. This project, which lasted about three and one-half weeks, was successful. However, the recommendations were that in the next series of continental tests consideration be given to conducting two separate courses for participants with varying backgrounds, and a proposal was submitted to the Civil Effects Test Group (CETG) for the inclusion of such a program in the next continental tests in which the FCDA would participate.

In addition to Project 36.1, there were two other training projects, Projects 36.2 and 36.5. They were designed to give more-advanced field training in radiological defense operations and technical experiments. Project 36.2 was titled Radiological Defense Monitoring and Data Evaluation, and Project 36.5 was titled Radiological Defense Training Operations.

The program for recruiting state and local radiological defense personnel for the training projects began Feb. 27, 1957, and was conducted through the FCDA regional offices. Recruiting

of personnel from federal agencies began in April 1957. Each state was requested to nominate two representatives and two alternates. Proper scheduling of applicants was difficult owing to shot-schedule changes, security clearances, and late receipt of nominees' names. Many were asked to attend a course at a time that was not convenient to them. These and other difficulties resulted in combining the May and June classes of Project 36.2 and the June class of Project 36.1 into one class. This class met from June 17 through 28.

The date for conducting the combined projects was determined primarily by the status of security clearances for participants and by funds for fiscal year 1957. The Restricted-Data security-clearance requirement for Project 36.1 was based on joint participation with projects of Program 35. Program 35 withdrew from June participation, allowing Project 36.1 to reduce clearance requirements to Limited Restricted Data. There were 35 participants of the combined project waiting for clearances the first week in June.

On June 7, all participants were mailed Government Transportation Requests and were advised that those not having security clearances could expect notification of clearance momentarily. Secret clearance for all nominees had been completed by June 12, and on June 10, 11, and 12, the 35 nominees were advised that security clearances had been completed.

Twenty-one participants, cleared for access to Restricted Data, were invited to attend the August–September session of Project 36.1. Sixteen participants accepted the invitations and arrived at the NTS on August 7.

Chapter 2

PROCEDURE

2.1 JUNE CLASS (COMBINED PROJECTS 36.1 AND 36.2)

Major emphasis was placed on radiation-survey field exercises in two areas contaminated by previous shots of this series. The participants collected and plotted survey data on maps. Classroom lectures were kept to the minimum required to acquaint the participants with the AEC Test Organization, the CETG, and the Military Effects Test Group (METG) and with programs of particular interest to radiological defense personnel. Participants (see Appendix B) observed two nuclear detonations and inspected their effects on structures.

2.1.1 Briefings and Discussions

All briefings and discussions were conducted on a non-Restricted-Data basis. Briefings were given by the CETG Director, program directors, project personnel from CETG, one project of METG, and the Chief of FCDA Operations. The briefings were based on radiological defense projects and other activities at the test site. The Test Director and the Test Manager briefed the group on reasons for conducting continental tests and on safety procedures employed to minimize off-site radiation hazards. Briefings on weather prediction, off-site monitoring, weapons effects, on-site radiological safety, cloud tracking, decontamination, and civil defense instrumentation were given. Time was allotted for each participant to outline his radiological defense training program, organization, and operational plans. The plans outlined were at the appropriate federal, state, county, or local level of organization. This provided an excellent opportunity for group discussions and evaluations of these programs. Discussions on FCDA instruments emphasized characteristics of instrument circuitry and maintenance. The schedule of participation is given in Appendix A.

2.1.2 Instrumentation

Each participant was issued the following equipment:

One CD V-730 radiological dosimeter, 0 to 20 r
One CD V-740 radiological dosimeter, 0 to 100 r
One CD V-760 radiological dosimeter, phosphate glass, 0 to 600 r
One CD V-138 radiological dosimeter, 0 to 200 mr
One Radiac calculator slide rule

Each survey team was issued the following equipment:

One CD V-700 radiological survey meter, low range, 0 to 50 mr/hr
One CD V-710 radiological survey meter, medium range, 0 to 50 r/hr
One CD V-720 radiological survey meter, high range, 0 to 500 r/hr

The participants kept this equipment during the entire training project. The survey meters are shown in Fig. 2.1.

The participants calibrated the CD V-700's on the Reynolds Electrical & Engineering Co. (REECO) Rad-Safe calibration range and the CD V-710's at the Evans Signal Laboratory facilities, METG, Project 2.5. With the latter, a 20× scope was used to read the meter dials at a distance of 50 yards.

During all radiation surveys of contaminated areas, the participants, wearing Radex clothing, used CD V-138 low-range dosimeters and CD V-700 and CD V-710 survey meters.

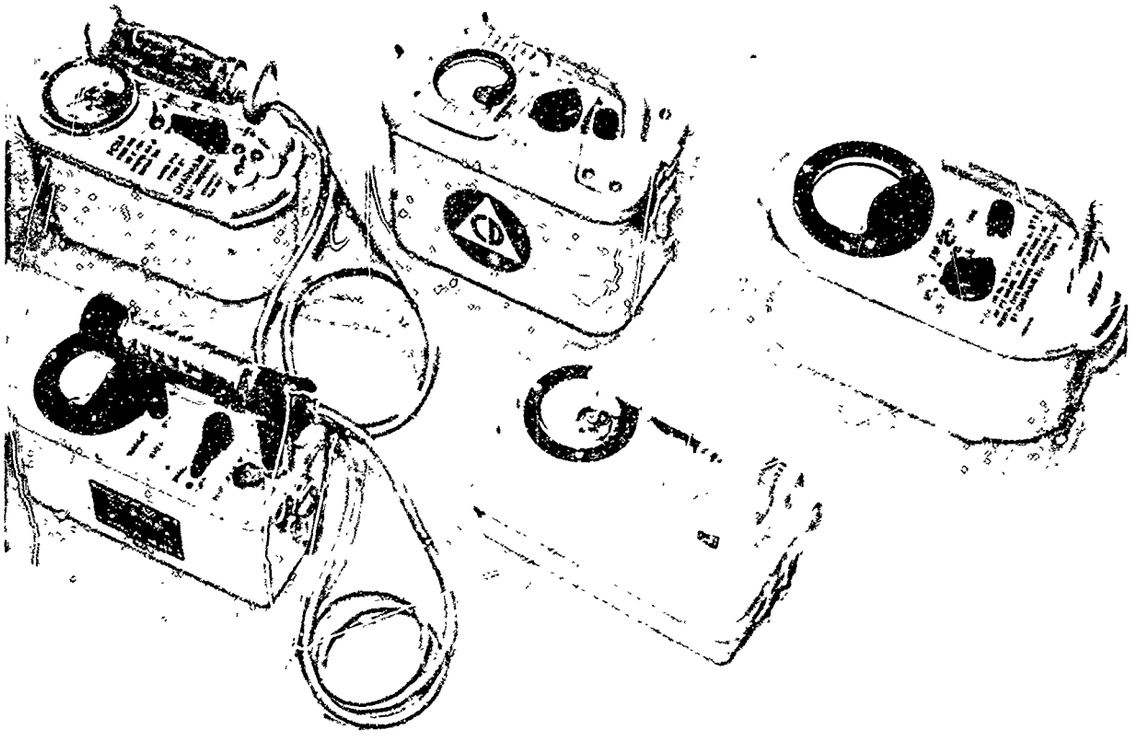

Fig. 2.1—Survey meters (left to right: CD V-700, CD V-710, and CD V-720).

2.1.3 Radiation-survey Exercises

Three field-survey exercises at contaminated shot areas were conducted with calibrated survey meters: CD V-700 Geiger counters and CD V-710 ion chambers. The third survey exercise was performed in the following manner: Seventeen survey teams consisting of two people each were spaced 10 paces apart along a straight line running east and west on the south side of an old shot area. Each team proceeded due north, taking readings at intervals of 10 paces for a total of 130 readings per team. The dose rates varied from less than 10 mr/hr to 490 mr/hr. The data, compiled and tabulated at Mercury, are given in Table 2.1. The data were plotted to scale, and isodose-rate lines of 100, 200, 300, and 400 mr/hr were drawn.

2.2 AUGUST–SEPTEMBER CLASS

The Project 36.1 program for the August–September class was drastically changed from that of the June class. Project personnel participated in the technical projects of Program 35, doing more advanced work than the earlier class. Security clearances for access to Restricted Data permitted the participants to receive more technical information about radiation, instrumentation, and weapons effects. In addition, the group was scheduled for six shot observations, as shown in Appendix A.

Table 2.1—RADIATION SURVEY DATA*
(Readings in Milliroentgens per Hour)

Reading position No.	Team No. 17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
130	40	80	80	90	80	60	80		75	80	75		70	90	85	23	50
129	50	87	90	100	90	70	90		80	95	80		80	100	90	28	55
128	50	98	100	100	100	80	140	70	80	100	85	70	84	105	100	30	59
127	50	110	100	110	110	80	150	80	90	110	100	75	100	120	110	30	65
126	50	110	110	120	110	90	160	83	100	110	110	90	115	130	120	35	85
125	60	115	115	140	130	90	170	95	100	140	125	95	130	140	130	40	85
124	70	130	120	160	140	100	180	100	120	150	135	100	140	150	150	50	90
123	70	140	140	160	150	110	190	110	130	165	150	120	160	120	160	60	100
122	80	150	160	180	170	110	220	110	150	180	165	120	175	190	180	60	110
121	80	160	170	190	180	120	230	140	160	200	180	150	200	210	190	68	120
120	80	180	130	200	190	140	240	150	180	220	200	160	205	220	210	80	135
119	100	200	200	220	210	150	260	173	190	220	208	170	220	240	230	85	145
118	120	220	200	230	240	160	280	183	200	250	230	190	240	270	240	100	150
117	130	250	220	260	250	180	300	203	220	280	225	200	280	300	260	100	170
116	150	240	240	280	260	200	330	220	240	300	280	230	310	320	280	120	180
115	155	250	260	280	290	200	350	240	260	330	295	250	330	340	300	123	195
114	160	280	280	300	310	220	360	257	280	345	320	280	370	360	320	135	205
113	170	300	300	315	340	240	380	275	290	370	340	300	400	400	340	140	220
112	180	310	320	315	360	250	390	297	320	390	363	310	410	420	360	145	230
111	190	320	325	325	370	260	410	320	330	410	390	370	430	440	360	160	245
110	190	340		335	390	280	440	337	350	420	415	380	440	425	370	165	255
109	200	350	348	335	410	300	460	380	360	440	420	400	460	450	400	175	270
108	210	350	355	360	420	310	420	380	380	440	440	400	435	480	390	180	270
107	210	350	355	315	430	310	470	410	390	450	440	420	490	490	380	180	280
106	210	345	355	333	440	320	470	420	380	440	435	460	470	470	400	178	290
105	210	340	345	333	440	310	440	430	350	410	420	380	470	480	400	180	300
104	200	338	360	340	430	280	400	430	280	320	340	360	450	420	350	180	310
103	220	340	348	328	420	300	370	420	320	420	360	330	360	450	370	180	308
102	220	340	340	308	420	300	380	400	290	360	375	280	280	400	380	180	300
101	220	318	345	312	400	280	400	363	320	350	380	370	380	370	360	180	245
100	210	328	335	308	390	280	400	360	330	390	385	390	420	390	325	165	260
99	200	325	313	273	380	270	390	380	300	380	350	370	475	370	320	180	250
98	195	288	293	275	360	260	360	380	290	380	330	360	397	360	300	140	235
97	190	258	260	260	340	240	360	355	290	373	305	350	380	340	260	136	200
96	170	218	242	233	310	220	310	320	260	345	295	350	340	300	230	107	140
95	155	225	220	215	290	200	280	320	220	300	270	300	320	280	210	102	180
94	140	218	201	200	270	200	280	300	210	280	250	290	300	260	210	100	170
93	140	200	200	193	240	180	250	281	200	273	235	260	275	250	205	95	160
92	126	190	190	180	230	160	220	260	190	250	210	240	255	230	190	83	145
91	118	170	180	160	210	150	200	250	170	220	200	230	235	210	170	82	135
90	110	160	164	153	200	150	190	230	160	210	180	210	220	200	160	72	120
89	100	150	160	150	130	140	170	210	150	190	160	190	200	190	140	62	110
88	90	140	140	135	170	120	160	190	140	180	140	175	175	170	135	60	100
87	87	120	114	120	150	120	140	170	130	160	135	160	140	155	120	60	100
86	83	120	120	120	142	100	130	157	120	150	120	150	135	135	115	52	90
85	80	120	115	110	128	95	130	150	110	130	110	140	120	130	110	43	80
84	80	110	100	102	120	90	120	140	100	125	100	125	110	120	100	42	75
83	70	98	100	103	110	80	110	130	95	110	95	110	109	115	85	41	70
82	60	98	93	100	100	80	100	120	85	90	85	100	90	100	80	58	60
81	82	90	60	95	95	70	80	110	80	85	80	95	80	90	65	33	55
80	48	80	60	85	85	60	90	98	75	80	75	90	78	80	65	44	46

*Readings were taken at intervals of 10 paces; teams were placed 10 paces apart

Fig. 2.2—Beta-absorption instrument.

2.2.1 Instrumentation

FCDA instruments were used throughout the project. Each trainee was issued the following equipment:

Three pocket ionization-chamber dosimeters
1. CD V-138, 0 to 200 mr
2. CD V-730, 0 to 20 r
3. CD V-740, 0 to 100 r

One CD V-760 phosphate glass dosimeter, 0 to 600 r
One REECO Rad-Safe film badge
One CD V-700 Geiger counter survey meter
One CD V-710 ionization-chamber survey meter } See Fig. 2.1
One CD V-720 ionization-chamber survey meter

The maximum cumulative reading of any trainee was about 2500 mr.

A set of instructions for calibrating the instruments and plotting calibration curves was issued to each trainee. Most of the trainees used a photoinstrument panel, which was employed by Project 35.3 in vehicle and aerial survey experiments. Several of the trainees used an instrument composed of seven ionization chambers (Fig. 2.2), which was used by Project 35.4 for beta-gamma ratio measurements.

The CD V-700 Geiger counter survey meters were calibrated by trainees using the REECO Rad-Safe facilities at CP-2. Instruments were checked for background reading and then were placed at various distances along radial two-by-four fences from a 29-mc Co^{60} source.

CD V-710 survey meters were calibrated at CP-2 with the REECO Rad-Safe UDM-1 calibration unit, which contains a 3.1-curie Co^{60} source. This calibration unit is the type developed by the National Bureau of Standards for the Bureau of Ships and is similar to a unit being procured for the FCDA use.

2.2.2 Radiation-survey Exercises

Participants conducted three radiation surveys at approximately H+3, H+5, and H+7 hr on three separate shots for Project 35.3. Eight flew aerial survey missions for Projects 35.3 and 36.4. In addition, foot and vehicle surveys were conducted for Project 35.3 with the photoinstrument panel and CD V-710 survey meters. The foot surveys were conducted as follows: a power wagon was driven approximately 50 ft from a limed marker; the monitor dismounted and walked to the limed marker, recording the instrument reading.

Four participants conducted radiation surveys on two shots for Project 35.4, using an instrument consisting of seven ion chambers (Fig. 2.2). The instrument was used to measure beta-gamma absorption for various thicknesses of aluminum. These values were used to determine the beta-gamma ratio of the fallout radiation. One survey was conducted for Project 35.2 prior to decontamination of a building and the surrounding terrain and after decontamination to determine the effectiveness of the methods used.

Two surveys of an old shot area were conducted by all participants. The area was staked at 0.1-mile intervals with 3-ft stakes, six stakes across the pattern and eight stakes deep. Readings and corrections were made, and the results were plotted on graph paper. These surveys were conducted on H+28 and H+35 days. The data plotted for each survey were compared to point out the decay of mixed fission products.

Chapter 3

RESULTS

3.1 JUNE CLASS

All objectives for the combined project set forth in Sec. 1.1 were attained, but certain aspects of the training program could have been improved. Plans for future operations should include more radiation-survey exercises. Decontamination of terrain was not accomplished as planned.

The general opinion of the participants was that the project was worthwhile and that the information and experience received was well worth the costs involved. The most valued phases of the project were participation in radiation surveys of contaminated areas, observation of two nuclear detonations, and observation of the postshot effects of these detonations.

Some participants suggested that more time should have been devoted to briefings, lectures, instrumentation, food and water sampling, actual decontamination, radiological defense operations, weapons design and development, and communications for radiological defense operations. Perhaps an additional week would have allowed these suggestions to be carried out satisfactorily.

3.2 AUGUST–SEPTEMBER CLASS

All objectives set forth in Sec. 1.1 were attained. The trainees observed five detonations and participated in surveys on four shots with projects of Program 35. A general understanding by the trainees of principles of calibration was evident from group discussions. In this session more experience in radiation survey was possible as a result of more shot observations and participations. However, field operations were still limited by lack of sufficient communications equipment.

Each trainee was issued a CD V-700 Geiger counter survey meter and a CD V-710 ionization-chamber survey meter, which operated within standard limits of accuracy. Plots of intensity vs. $1/d^2$ for the Geiger counter calibration exhibited the inverse-square attenuation of intensity with distance from a point source. The straight-line extrapolation to $1/d^2 = 0$ gave a background reading that agreed with the readings taken in the absence of the radioactive source.

Radiation surveys of old shot areas produced irregular patterns similar to those obtained by REECO Rad-Safe. A new appreciation for field monitoring techniques was derived from these exercises. Each participant expressed his appreciation for the values of the project and recommended that future projects of this type be conducted in all future continental testing programs.

Chapter 4

CONCLUSIONS AND RECOMMENDATIONS

The participants considered both sessions of the project to be very worthwhile indoctrination in field radiological monitoring and nuclear weapons effects testing. They were responsible individuals who volunteered their time to attend the program because of their interest in radiological defense. They were eager to learn and expressed much satisfaction over their experiences. It is recommended that all future Nevada tests incorporate as many such programs as possible. This will not only provide civil defense and emergency government activities with more inspired and experienced leadership but will also increase public understanding of the purposes that support the nuclear weapons tests in Nevada and the caution with which they are conducted.

Recommendations for future projects follow:

1. The participation in technical projects was of great value and should be continued in all future testing programs. Civil defense participants should be used in technical programs other than FCDA programs, such as prompt-radiation dosimetry, decontamination studies, biomedical tests, shielding, and instrumentation and dosimetry.

2. Recruiting of participants should be started at least six months before the scheduled beginning of the course at the test site.

3. Project officers should arrive at the test site at least three weeks prior to the beginning of a project to arrange lecture and work space, transportation, communications, housing, areas for field-survey exercises, and specific schedules, including lectures from other projects and programs, to implement the plans for a well-coordinated program insofar as is possible.

4. Each session should be composed of persons having as homogeneous a background in radiological defense as possible. However, this criterion should not be used to restrict the number of those attending, because it was found that, even with groups of varying background, the vast majority can absorb the important aspects of a well-presented program.

5. The maximum number of persons that can be accommodated effectively in a single session is 25.

6. Arrangements should be made in advance to obtain, test, and use civil defense radio equipment rather than rely on the limited supply available at the test site.

7. Facilities should be provided at the test site specifically for lecture and work space. Heat and noise in the improvised warehouse room made concentration on the part of participants difficult.

8. Planning for projects similar to this should begin well in advance of test participation to allow time to select participants and to arrange for clearances and scheduling.

Appendix A

OPERATIONAL SCHEDULES

A.1 JUNE CLASS

Date, 1957	Time	Event	Speaker
June 17	0800	Introduction and Objectives	Hugh D. Ivey, Director, Program 36
	0825	Test Director	Dr. G. Johnson
	0840	Test Manager	Dr. J. Reeves
	0900	CETG Programs	Robert L. Corsbie, Director, CETG
	0920	NTS Radiological Defense Training	Dr. Stafford Warren, Dean of Medical School, UCLA
	0950	FCDA Programs in CETG	Edward R. Saunders, Jr., Chief, FCDA Operations
	1030	Security	R. McCurtain, Security
	1050	Classification	J. M. Ayers, Classification Advisor, Test Manager's Staff
	1110	Facilities at Mercury	Thomas R. Huff, Assistant Director, Program 36
	1130	Projects 36.1 and 36.2 Objectives and Purpose	Project Officer, Project 36.1
	1300	Test Site Map Orientation	Project Officer, Project 36.1
	1320	Review of FCDA Instruments	Project Officers
	1400	Issue of Instruments, Materials, Supplies, Etc.	Project Officers
	1530	Check Instruments	Project Officers
	1615	Group and Team Organization	Project Officers
	1630	Vehicle Control and Operator Permits	Asst. Project Officer, Project 36.1
June 18	0300	Depart for FCDA Observation Area	Project Officers
	0430	Observe Shot	
	0530	Arrive Mercury	
	1300	Tour Frenchman Flat: Observe Shelters, Structures, and Equipment	Hal J. Jennings, Director, Program 30

Date, 1957	Time	Event	Speaker
June 19	0800	On-site Rad-Safe Orientation	S. Schenck and W. J. Brady. Training Branch, REECO Rad-Safe
	1330	Calibration of CD V-700 Survey Meters, REECO Rad-Safe	Project Officer, Project 36.2
	1545	Calibration of CD V-710 Survey Meters, Evans Signal Lab.	Project Officer, Project 36.2
	1900	Plotting of Calibration Data	Project Officer, Project 36.2
June 20	0800	Weather	Maj. Charles P. Hoyle, Station Weather Officer, USAF
	0830	Fallout Prediction	Dr. Vay Shelton, Chief, Fallout Prediction Unit
	0915	Air Space Closure (Cloud Tracking)	Roscoe Goeke, Rad-Safe Advisor, Test Manager's Staff
	1015	Organization and Control Survey Exercise	Project Officers
	1030	Safety Criteria, Survey Exercises	Project Officer, Project 36.1
	1130	Survey Area Orientation	Project Officer, Project 36.1
	1330	Tour of Military Effects Test Program, Frenchman Flat	Lt. Col. Wade Hitt, Asst. Deputy Director, DOD
	1440	Group Photograph (News Knob)	Project Officer, Project 36.2
	1445	Tour of Yucca Flat	Project Officers
June 21	0800	Radiation Survey of Old Shot Area No. 7	Project Officer, Project 36.1
	1330	Calibration of CD V-710 Survey Meters, Evans Signal Lab.	Project Officer, Project 36.2
	1500	Effects of Nuclear Fallout on Foodstuffs	Dr. E. P. Laug, Director, Program 38
	1530	Blast and Thermal Effects on Structures, Equipment, Devices, and Components	James E. Roembke, Director, Program 31
	1615	Biological Assessment of Blast Effects	Dr. Clayton S. White, Director, Program 33
June 22	0730	Radiation Survey of Old Shot Area No. 9	Project Officers, Projects 36.1 and 36.2
	1200	Recreation	
June 23	0300	Depart for FCDA Observation Area	Project Officers
	0430	Shot Negative	
	0530	Return to Mercury	Project Officers
June 24	0300	Depart for FCDA Observation Area	Project Officers
	0445	Observe Shot	
	0545	Arrive Mercury; Dismissed Until 1300	Project Officers
	1300	Radiation Survey of Old Shot Area No. 9	Project Officer, Project 36.1
	1630	Tour Underground-shot Areas	Project Officer, Project 36.1

Date, 1957	Time	Event	Speaker
August 13	0800	Instrument Operation and Application	Asst. Project Officer, Project 36.1
	0940	CETG Programs	L. Joe Deal, AEC Assistant to Director, CETG
	1040	FCDA Programs in CETG	Edward R. Saunders, Jr., Chief, FCDA Operations
	1300	Staking and Preliminary Survey of Area No. 2	Project Officer, Project 36.1
	1630	Orientation for NRDL Shelter and Instrumentation of Project 35.1	Project Officers
August 14	0800	Depart for Rad-Safe	Project Officers
	0900	Dry Run Survey of Area No. 2b	Project Officers
	1330	Briefing of Program 35	J. O. Buchanan, Consultant, Program 35
	1350	Briefing of Project 35.1	Project Officer, Project 35.1
	1420	Briefing of Project 35.2	Project Officer, Project 35.2
	1450	Briefing of Project 35.4	Project Officer, Project 35.4
	1700	Orientation for Activities of Project 36.1 in Projects of Program 35	Project Officer, Project 36.1
August 15	0730	Depart for Rad-Safe	Project Officers
	0900	Proceed with Staking and Survey of Old Shot Area No. 2	Project Officer, Project 36.1
	1115	Briefing and Tour of NRDL Shelters	Project Officer, Project 32.3
	1415	Program 33 and Blast Phenomena	Dr. C. S. White, Director, Program 33
	1600	Plotting of Radiation Survey Data	Project Officer, Project 36.1
August 16	0830	Plotting of Radiation Survey Data	Project Officer, Project 36.1
	0930	Decontamination Procedures, Techniques, and Data	Carl Miller, Director, Program 32
	1300	Depart for Area No. 2c	Project Officer, Project 35.3
	1400	Staking and Liming of Area No. 2c	Project Officer, Project 35.3
August 17		Free Time	
August 18	0310	Depart for FCDA Observation Area	Project Officers
	0500	Observe Shot	
	0530	Briefings and Orientation for Participation in Projects 35.4 and 36.4	Project Officers, Projects 35.4 and 36.4
	0600	Participation in Projects 35.4 and 36.4	Project Officers, Projects 35.4 and 36.4
	1730	Return to Mercury	
August 19	0900	Briefings and Participation in Projects 35.3 and 35.4	Project Officers, Projects 35.3 and 35.4

Date, 1957	Time	Event	Speaker
	1030	Briefing of Movie: "Mission Fallout," Project 36.3	Project Officer, Project 36.3
	1330	Discussion of Project Participation in Projects 35.3, 35.4, and 36.4	Project Officer, Project 36.1
	1400	Test Manager	J. Reeves
August 20	0800	Depart for Rad-Safe	Project Officers
	0930	Radiation Survey of Old Shot Area No. 2b	Project Officer, Project 36.1
	1430	Briefing of Project Participation in Project 35.3	Project Officer, Project 35.3
	1500	Dry Run and Reliming of Shot Area No. 7	Project Officer, Project 36.1
	2000	Group Discussion of FCDA Radiological Defense Problems	Project Officer, Project 36.1
August 21	0800	Results of Project 36.4 and Application of Aerial Radiological Survey to Civil Defense	Project Officer, Project 36.4
	0925	Project 35.3 Participation	Project Officer, Project 35.3
	1020	FCDA Instrument Maintenance and Repair	Robert Mothersole
	1300	FCDA Advisory Bulletin No. 193	Project Officer, Project 36.1
	1330	Prompt Radiation and Dosimetry	Project Officer, Project 39.5
	1600	Plotting of Radiation Survey Data	Project Officer, Project 36.1
August 22	0800	Briefing of Project 36.5	Bruce Ault
	1000	FCDA Instrument Maintenance and Repair	Robert Mothersole
	1300	Briefing of Program 37	Kermit Larson, Director, Program 37
	1430	Briefing of Program 34	L. Vortman, Director, Program 34
	1530	Briefing of Program 39	L. Joe Deal
August 23	0300	Departure for FCDA Observation Area	Project Officers
	0500	Observe Shot	Project Officers
	0800	Participation in Projects 35.3 and 35.4	Project Officers, Projects 35.3 and 35.4
August 24	0800	Participation in Project 35.4	Project Officer, Project 35.4
August 25		Free Time	
August 26	0600	Orientation, Liming, and Dry Run of Participation in Project 35.3	Project Officer, Project 35.3
	1430	Weather	Maj. C. Hoyle
	1515	Fallout Prediction	K. Nagel
	1610	Cloud Tracking	Roscoe Goeke
August 27	0730	Radiation Survey of Old Shot Area No. 7	Project Officers
	1300	FCDA Instrument Maintenance	Robert Mothersole
	1430	Off-site Monitoring	O. Placak and Staff

Date, 1957	Time	Event	Speaker
August 28	0800	Tour of Area No. 2	Project Officers
	1300	METG Program	Lt. Col. Hitt
	1500	Biomedical Weapon Tests	Col. C. Maupin
	1600	Instrument Evaluation, Project 35.4	Project Officer, Project 35.4
	1900	FCDA Survival Projects	Project Officer, Project 36.1
August 29	0700	Staking and Liming of Area No. 2, Project 35.3	Project Officer, Project 35.3
	1330	FCDA Shelter Program and Policy	Benjamin C. Taylor
	1415	Project 31.1	Project Officers, Projects 31.1 and 31.5
	1430	Project 37.6 (Film)	M. Knoles
	1620	Briefing of METG Program 2	Cmdr. Fracer
August 30	0400	Depart for FCDA Observation Area	Project Officers
	0540	Observe Shot	Project Officers
	0830	State and Local Civil Defense Representatives Reports	
	1400	Biomedical Test Programs	Col. C. Maupin
	1500	Off-site Monitoring Veterinarian	E. Johnson
August 31	0330	Depart for FCDA Observation Area	Project Officers
	0500	Observe Shot	Project Officers
	0800	Briefings and Orientation of Participation in Projects 35.2 and 35.3	Project Officers, Projects 35.2 and 35.3
	1000	Participation in Projects 35.2 and 35.3	Project Officers, Projects 35.2 and 35.3
September 1	0600	Participation in Project 35.3	Project Officer, Project 35.3
September 2	0400	Depart for FCDA Observation Area	Project Officers
	0540	Observe Shot	Project Officers
	0800	Participation in Project 35.3	Project Officer, Project 35.3
	1930	Prompt Radiation Dosimetry	Henry Borella
	2100	Turn in Instruments and Equipment	Project Officer, Project 36.1
September 3	0815	Results of Project 35.3	Project Officer, Project 35.3
	0850	Evaluation of Project 36.1	Edward R. Saunders, Jr., Chief, FCDA Operations
	0930	Turn in Vehicles	Project Officer, Project 36.1
	0950	Closing Comments	Robert L. Corsbie, Director, CETG
			Hugh D. Ivey, Director, Program 36
			Project Officer, Project 36.1
	1300	Departure of Participants	Project Officer, Project 36.1

Appendix B

LISTS OF PARTICIPANTS

B.1 JUNE CLASS

Name	Address	Civil defense organization
Alderman, George W.	116 E. Pleasant St. Amherst, Mass.	Member of the Massachusetts State Advisory Committee on Radiation
Aponte, Ernest L.	1005 Ridge Road, W. Rochester 15, N. Y.	Chief, Radiological-Chemical Service Monroe County CD
Armstrong, William R.	4410 Fuller Drive Kensington, Md.	Dept. of Commerce
Ball, John N.	2555 S. Joyce St. Arlington, Va.	Wild Life Service Dept. of Interior
Byers, Robert H.	121 Thomas Road Decatur, Ga.	Chief, Radiation Training Georgia CD
Cherry, Duane A.	3821 Newark St., N.W. Washington, D. C.	Police Department CD Liaison Office
Dumm, Richard S.	Weare Road Henniker, N. H.	Headquarters Staff, Radiological Defense New Hampshire CD
Dunham, John W.	Galesville, Md.	Arch. and Structure Div. General Services Administration
Foulke, Clarence D.	310 Westwood Road Steubenville, Ohio	Radiological Section Chief Hancock County CD
Gawley, Irwin H.	177 McCosh Road Upper Montclair, N. J.	Radchem Team Member New Jersey CD
Geagley, William	526 W. Ottawa St. Lansing, Mich.	Chief Chemist and Director of Chemical Lab. Div., CD
Hallwhich, William	22929 Gary Lane St. Clair Shores, Mich.	Defense Protection Supervisor Michigan Bell Telephone Co.
Harrison, L. H.	208 North Wayne Arlington, Va.	U. S. Bureau of Mines Dept. of Interior

Name	Address	Civil defense organization
Hunter, Paul H.	768 Westover Ave. Winston-Salem, N. C.	Radiological Defense Winston-Salem City and Forsyth County CD
Jenkins, Walter A.	10468 Nottingham Detroit, Mich.	Operations Coordinator Detroit CD
Kasuba, Frank J.	7 Matthews St. Binghamton, N. Y.	Deputy Director, Special Weapons Service Broome County CD
Kirby, John F.	7390 Fort Foote Road Fort Foote, Md.	General Services Administration
Kuehn, Robert K.	6510 41st Ave. University Park Hyattsville, Md.	Civil Engineering Div. U. S. Coast Guard
Lewis, Rudolph P.	1312 Eastland Drive Decatur, Ga.	Asst. Chief of Radiation Training Georgia CD
McLoughlin, David P.	FCDA Battle Creek, Mich.	Training Officer Radiological Defense School, FCDA
McTigue, Austin C.	154 Hodge Ave. Buffalo 22, N. Y.	Deputy Director Consolidated Erie County CD
Menzer, Carl H.	32 Highland Drive Iowa City, Iowa	Consultant, Radiological Defense Iowa CD
Merkel, Harrison H.	7512 Summit Place Alexandria, Va.	Dept. of Justice
Moseley, Albert G., Jr.	3227 First Street, N. Arlington 1, Va.	Veterans Administration
Orr, William C.	Route No. 2 Storrs, Conn.	Radiological Advisor Connecticut CD
Patterson, Charles S.	5 Furman Faculty Apts. Greenville, S. C.	Deputy Chief, Radiological Defense Greenville County CD
Penczek, Edward S.	20141 McIntyre Detroit, Mich.	Captain, Detroit Fire Dept. Detroit Office of CD
Petrie, Finlay L., Jr.	6702 New Hope Drive Springfield, Va.	Dept. of Labor
Pettee, James C.	4971 34th Road, N. Arlington 7, Va.	Office of Defense Mobilization
Randall, Wincel R.	1885 South Lowell Denver, Colo.	Post Office Dept.
Roberts, Harvey J.	411-a C St. St. Albans, W. Va.	Asst. Chief, Radiological Defense West Virginia CD
Singh, Bhagat	1515 West Barker Peoria, Ill.	
Smith, Thomas J.	Holy Cross College Worcester, Mass.	Member, Radiac Advisory Committee Massachusetts CD

Name	Address	Civil defense organization
Taylor, Albert E.	805 S. 19th Ave. Pocatello, Idaho	Asst. Training Officer Idaho CD
Vimpeny, Leonard C.	728 Palm Drive Aiken, S. C.	Civil Defense Chairman Aiken CD Council
Vose, Charles E.	3 South Brattleboro, Vt.	Rad. Deputy No. 9 Vermont CD
Webster, William M.	215 Bonnie Brae Denton, Tex.	FCDA Region 5
Williams, Leslie W., Jr.	246 Colman St. New London, Conn.	Chairman, Radiological Defense Committee Connecticut CD
Williamson, Edwin R.	308 15th Ave., S.E. Aberdeen, S. D.	Area Radiological Defense Leader South Dakota CD
Young, Floyd F.	509 Military Drive Coeur D'Alene, Idaho	Asst. Training Officer State Radiological Defense Section Idaho CD

B.2 AUGUST–SEPTEMBER CLASS

Name and home address	Business address	Civil defense organization
Bowlin, Willard O. 1040 Pinon Loop Los Alamos, N. Mex.	Disaster and Defense Planning Specialist Project Services Branch Los Alamos Area Office, AEC	
Briggs, Henry C. 3360 N. Grant Ave. Indianapolis 18, Ind.	Sanitary Engineer Indiana State Board of Health 1330 W. Michigan St. Indianapolis, Ind.	Member, Radiological Defense Station Indiana Dept. of CD
Broughton, Arthur L. 1324 W. Bewick Fort Worth, Tex.	Occupational Health Sanitarian City of Fort Worth Health Dept. Fort Worth, Tex.	With R. E. Dysart, Director, CD City of Fort Worth Fort Worth, Tex.
Burnett, William T. 1145 Magnolia Woods Drive Baton Rouge, La.	Dept. of Chemistry Louisiana State University Baton Rouge, La.	Louisiana CD Agency
Emmons, Ardath H. Phoenix Memorial Lab. University Campus University of Michigan Ann Arbor, Mich.	Ann Arbor, Mich.	Technical Advisor Michigan Office of CD Lansing, Mich.
Estee, Charles R. 109 S. Yale Vermillion, S. D.	Dept. of Chemistry State University of South Dakota	Associate Director Radiological Monitoring South Dakota

Name and home address	Business address	Civil defense organization
Gajan, Dr. I. W. Box 145 or 325 Indest St. New Iberia, La.	Estorage Bldg. New Iberia, La.	Director, Medical Services CD, Iberia Parish New Iberia, La.
Gray, Leven B. 1605 Jefferson Heights Apartments Jefferson City, Mo.	Radiological Health Physicist Bureau of Occupational Health Missouri Div. of Health Jefferson City, Mo.	Missouri CD Agency
Hogan, Dr. Joseph T. 321 Doerr Drive Arabi, La.	U. S. Dept. of Agriculture Southern Regional Research Lab. New Orleans, La.	Radiological Section New Orleans CD
Killian, Ben C. 159 Gregg Drive Battle Creek, Mich.	Radiological Defense Officer FCDA Region 4 Battle Creek, Mich.	FCDA
Laitinen, William R. 17 Russell Ave., S. Minneapolis 5, Minn.	Supt. of Radio Minneapolis Police Dept. Minneapolis, Minn.	In Charge of Instrument Maintenance Minneapolis CD Minneapolis, Minn.
Murtaugh, Rev. Walter A., O.P. Providence College Providence 8, R. I.	Providence College Providence 8, R. I.	Instrument Calibration and Monitoring CD of Rhode Island Armory Mounted Command N. Main Street Providence, R. I.
Pero, Robert F. 9005 Michaux Lane Richmond 26, Va.	Bureau of Industrial Hygiene Virginia State Health Dept. State Office Bldg. Richmond 19, Va.	
Reed, Dr. Rufus D. State Teachers College of Montclair Upper Montclair, N. J.	State Teachers College of Montclair Upper Montclair, N. J.	Northern States Rad-Chem Team New Jersey State CD
Shaw, Dr. Edward I. 721 Rhode Island St. Lawrence, Kans.	Radiation Biophysics Program University of Kansas Lawrence, Kans.	Alternate Deputy for Radiological Monitoring Kansas State CD
Thomas, James E. 256 S. Brunswick Marshall, Mo.	Physics Department Missouri Valley College Marshall, Mo.	Missouri CD Agency
Tolan, Mrs. Marjorie, C.R.T. 3229 Mathieson Drive Atlanta, Ga.	Director, School of X-ray Technology Emory University Hospital Emory University, Ga.	Representative of American Society of X-ray Technicians Metropolitan Atlanta CD
Young, Otis B. 1326 S. Thompson St. Carbondale, Ill.	Director, Atomic and Capacitor Research Southern Illinois University Carbondale, Ill.	Director, Radiological Defense Southern Illinois University Carbondale, Ill.

Appendix C

GROUPING OF PERSONNEL

C.1 JUNE CLASS

	Group A	Group B	Group C
Group Leader	C. Menzer	W. Hallwhich	E. Aponte
Asst. Group Leader	R. Lewis	E. Penczek	G. Alderman
Team No. 1	W. Armstrong	I. Gawley	R. Kuehn
	W. Randall	P. Hunter	E. Williamson
Team No. 2	F. Kasuba	A. Moseley	J. Ball
	W. Jenkins	F. Petrie	L. Harrison
Team No. 3	L. Williams	C. Vose	D. McLoughlin
	C. Foulke	B. Singh	J. Pettee
Team No. 4	W. Orr	A. Taylor	R. Byers
	C. Patterson	H. Roberts	L. Vimpeny
Team No. 5	R. Dumm	T. Smith	H. Merkel
	D. Cherry	W. Geagley	J. Dunham
Team No. 6		A. McTigue	W. Webster
		J. Kirby	F. Young

C.2 AUGUST–SEPTEMBER CLASS

Team No. 1	W. Bowlin*	Team No. 5	I. Gajan*
	H. Briggs		W. Laitinen
Team No. 2	A. Broughton*	Team No. 6	W. Murtaugh*
	C. Estee		R. Reed
Team No. 3	W. Burnett*	Team No. 7	E. Shaw*
	M. Tolan		O. Young
Team No. 4	L. Gray*	Team No. 8	J. Hogan*
	R. Pero		J. Thomas

*Team leader.

Appendix D

LIST OF PUBLICATIONS DISTRIBUTED

Publication or form No.	Subject or title
AB 73	Clothing for Protection Against Nuclear and Thermal Radiation
AB 89	Organizational Dosimeters
AB 127	Radiological Monitoring Instruments
AB 128	Instructions for Marking Contaminated Areas
AB 179	Residual Radiation in Relation to Civil Defense
AB 193	Availability of Radiological Instruments and Detection Devices for Training and Educational Purposes
TB 5-2	Shelter from Radioactive Fallout
TB 8-1	Blast Damages from Nuclear Weapons of Larger Sizes
TB 11-1	Emergency Exposures to Nuclear Radiation
TB 11-2	Personal Dosimeters for Radiological Defense
TB 11-3	The Most Promising Personal Dosimeters
TB 11-4	Development Status of Personal Dosimeters
TB 11-8	Permissible Emergency Levels of Radioactivity in Water and Food
TB 11-9	Emergency Measurements of Radioactivity in Food and Water
TB 11-15	Phosphate Glass Dosimetry
TB 11-19	Protection Against Fallout Radiation
TB 11-20	Radiological Instruments for Civil Defense
TB 11-21	Fallout and the Winds
TB 11-22	Radiation Physics and Bomb Phenomenology
TB 11-24	Medical Aspects of Nuclear Radiation
TB 19-1	The Radioactive Fallout Problem
TR 11-1	Effects of Nuclear Explosions upon Drugs
PA B-7	What You Should Know About Radioactive Fallout
FYI ES 194	Questions and Answers on Fallout
FYI ES 232	AEC Commissioner Libby Discusses Persistence of Radioactive Fallout
FYI ES 457	Test of Libby's Reply to Schweitzer Appeal To End Nuclear Tests
FCDA instrument specifications:	
CD V-138	Self-reading Training Dosimeter, 0-200 mr
CD V-457	Training Kit Case

Publication or form No.	Subject or title
CD V-700	Low-range Geiger Survey Meter, 0-50 mr/hr
CD V-710	Medium-range Ion-chamber Survey Meter, 0-50 r/hr
CD V-711	Fixed-station Remote Reading Meter
CD V-720	High-range Ion-chamber Survey Meter, 0-500 r/hr
CD V-730	Self-reading Operational Dosimeter, 0-20 r
CD V-740	Self-reading Operational Dosimeter, 0-100 r
CD V-750	Dosimeter Charger
CD V-786	Co^{60} Source Set
CD V-787	Food and Water Comparison Standard
CD V-788	Handling Tongs
CD V-791 and V-792	Lead Source Containers for CD V-786 Source Set
FCDA 24749	Radiological Equipment List
FCDA 24227	Instructions for Checking Operability of Radiological Instruments—Operating Memorandum No. 12 Revised
FCDA 25886	Calibration Curve CD V-700 Survey Meter
	Calibration (Checking) of CD V-700 Geiger Counter
	Calibration Exercise Data Sheet CD V-700
	Calibration Exercise Data Sheet CD V-710
	Table of Decay Correction Factors for Co^{60}
	Table of Distance Correction Factors for Decay of Co^{60}
	Monitor's Data Form
	List of Approximate Radiation Doses Commonly Encountered
	List of LD_{50} Radiation Doses from Gamma Radiation for Various Biological Groups
	List of Estimated Medical Effects of Radiation Doses Expressed as Percentage of Working Force Affected with Time of Exposure
	List of Effects with Time for Acute Doses of Radiation
FCDA BC 23713	Periodic Chart of the Atoms
	Table of Fission Products: Chains and Yields
	Fission Yield in Percentage Vs. Mass Number of Nuclei Formed in Fission of U^{235}
	The Electromagnetic Spectrum
FCDA BC 24575	Radiation Exposure and Effects Charts
FCDA BC 22403	Comparative Stock Numbers of Batteries by Various Manufacturers
FCDA BC 25065	Dose Calculations Problems
	Radioactive Material Label
FCDA BC 23630	Twelve Charts on Physical Effects of Nuclear Weapons
Safety and Fire Protection, TB-4, USAEC	Radiation Hazards in Fire Fighting
Farmers' Bulletin No. 2107, U.S. Dept. of Agriculture	Defense Against Radioactive Fallout on the Farm
	Radiation Monitoring Fundamentals for the Fire Service
	Plastic Dose and Decay Charts
	Cardboard Circular Slide Rule for Decay and Accumulated Dose
USAEC, February	Statement by Lewis C. Strauss, Chairman, The Effects of High-yield Nuclear Explosions

Publication or form No.	Subject or title
AFSWP 99	Dosage and Dose-rate Curves of Residual Radioactivity Based on Multiple Decay of Gross Fission Products
	Facts About the H-Bomb
	Facts About Fallout
Handbooks	"The Effects of Nuclear Weapons," AFSWP and USAEC
	"Your Nevada Test Site Information Handbook," USAEC
	"Background Information on Nevada Nuclear Tests," Office of Test Information, USAEC
	"Atomic Tests in Nevada"
	"Atomic Energy Commission Radiological Safety Criteria During Nuclear Weapon Testing at Nevada Test Site, April, 1957"
	"Preseries and Series Releases," Office of Test Information, USAEC, Nevada Test Site
	"Chemical Dosimetry," paper by S. Sigoloff et al.